Devi Suhitha Chundru

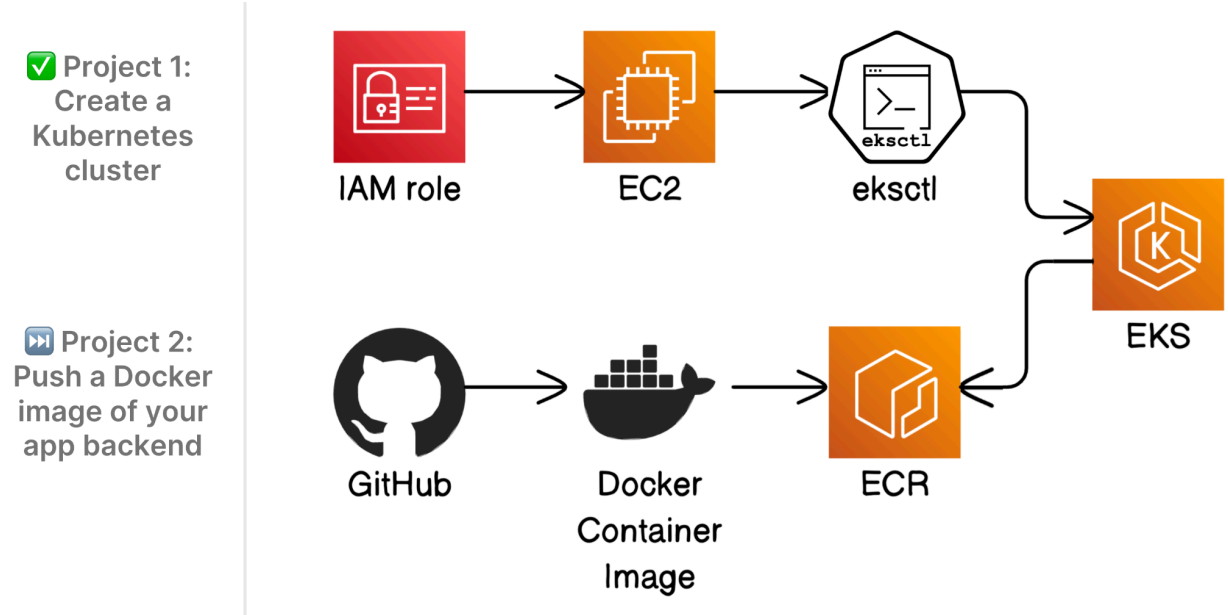
Cloud-Native Backend Deployment with Docker, ECR, and Amazon EKS

Prepared an app's backend for deployment with Kubernetes!

🎯 Project Objective

The objective of this project was to containerize a backend application and deploy it on a Kubernetes cluster using AWS services. The backend code was cloned from a GitHub repository, and a Docker image was built and pushed to Amazon Elastic Container Registry (ECR). The Docker image was then deployed to an Amazon Elastic Kubernetes Service (EKS) cluster. This project enhanced my skills in containerization, AWS ECR, and Kubernetes orchestration, while also reinforcing best practices for cloud-native deployments.

Architecture Overview



🛠️ Tech Stack

- **Git & GitHub** – Cloned the backend code and tracked changes
- **Docker** – Containerized the backend application
- **Amazon ECR** – Stored the Docker image for deployment
- **Amazon EKS** – Deployed the containerized app using Kubernetes
- **Amazon EC2** – Used as a management server to run commands
- **IAM** – Managed access and permissions for AWS services
- **eksctl** – Created and managed the EKS cluster
- **kubectl** – Deployed and managed Kubernetes resources on EKS

Step 1: Set up EC2 and EKS

Environment Setup

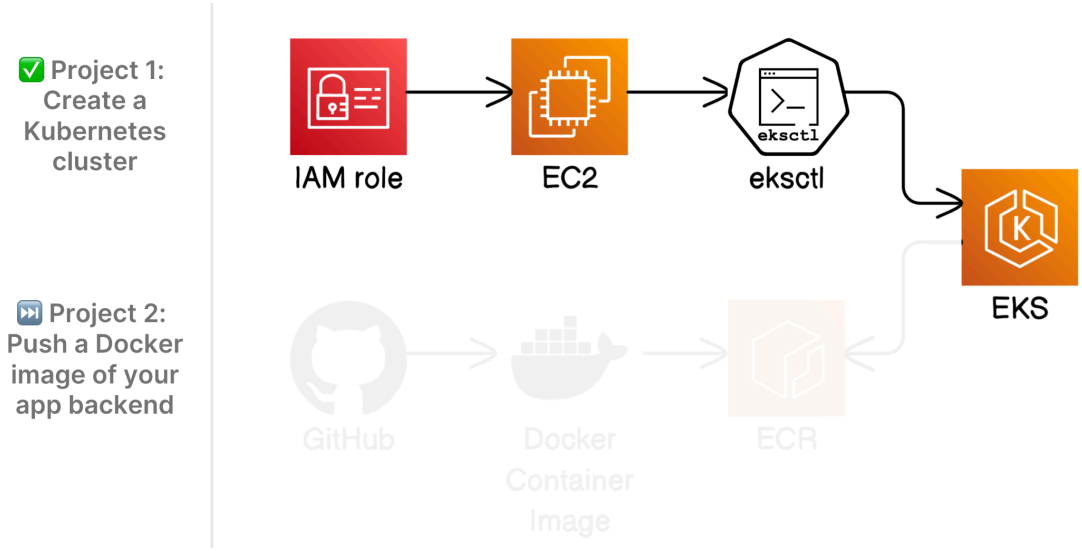
To begin the project, I set up the environment by launching an **Amazon EC2** instance. This instance served as my control machine, where I installed the necessary tools and executed all commands to provision and manage the Kubernetes infrastructure on AWS.

What is Amazon EKS?

Amazon Elastic Kubernetes Service (EKS) is a managed Kubernetes service by AWS that simplifies deploying, managing, and scaling containerized applications. It handles complex tasks like networking, security, and cluster management, allowing users to run Kubernetes without manually setting up the infrastructure.

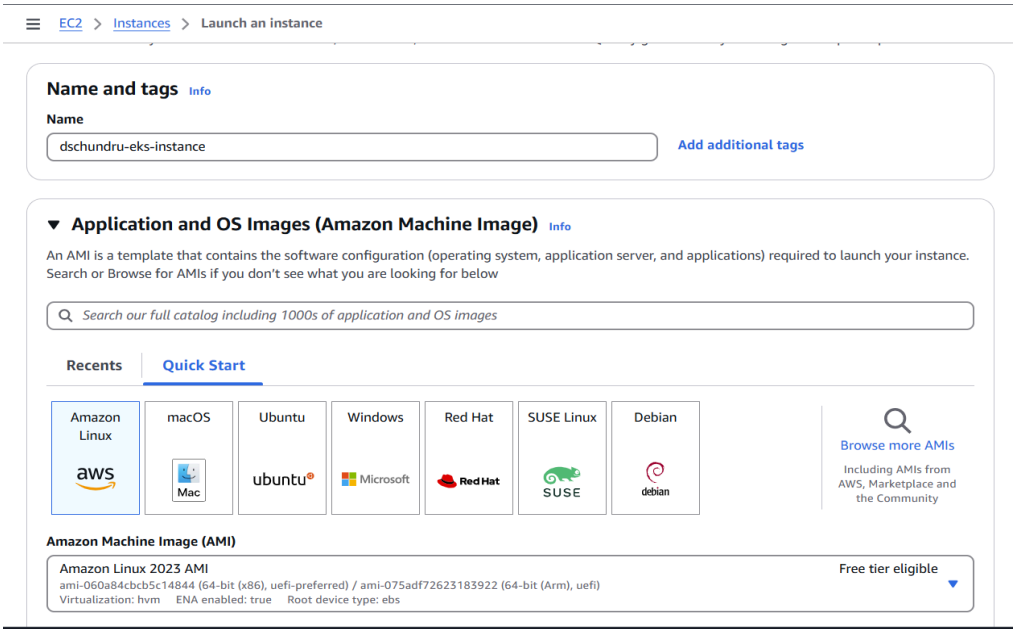
In this step, I:

- Launched and connected to an Amazon EC2 instance
- Set up **eksctl** and configured the instance with my AWS credentials
- Created an Amazon EKS cluster to manage my Kubernetes workloads



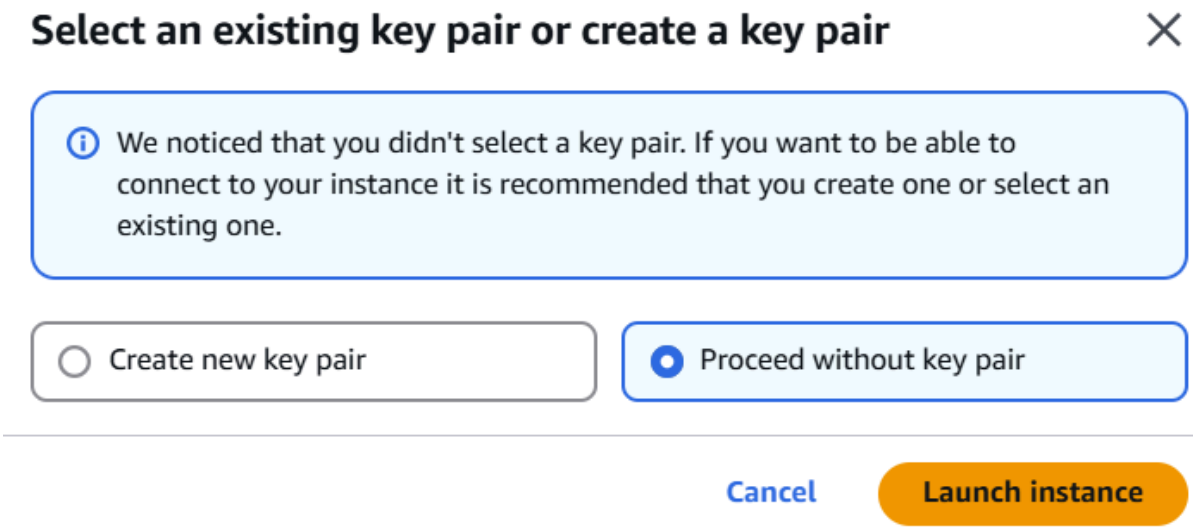
To get started, I navigated to the EC2 console in my AWS account.

- I made sure to select the AWS Region closest to my location for better performance.
- I clicked **"Launch instances"** to create a new virtual machine.
- I named my instance dschundru-eks-instance for easy identification.
- For the **Amazon Machine Image (AMI)**, I selected Amazon Linux 2023 AMI, which is optimized for compatibility with AWS tools and services.



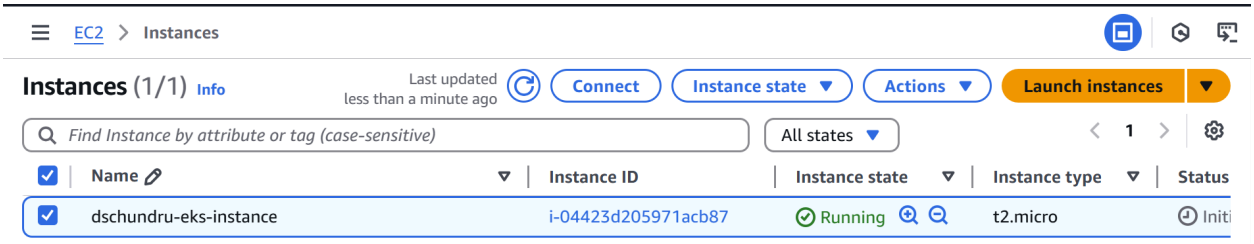
I chose **t2.micro** as the instance type since it's free-tier eligible. For the **network settings**, I kept the **default security group** for now.

- Select Launch instance and Proceed without a key pair (not recommended).

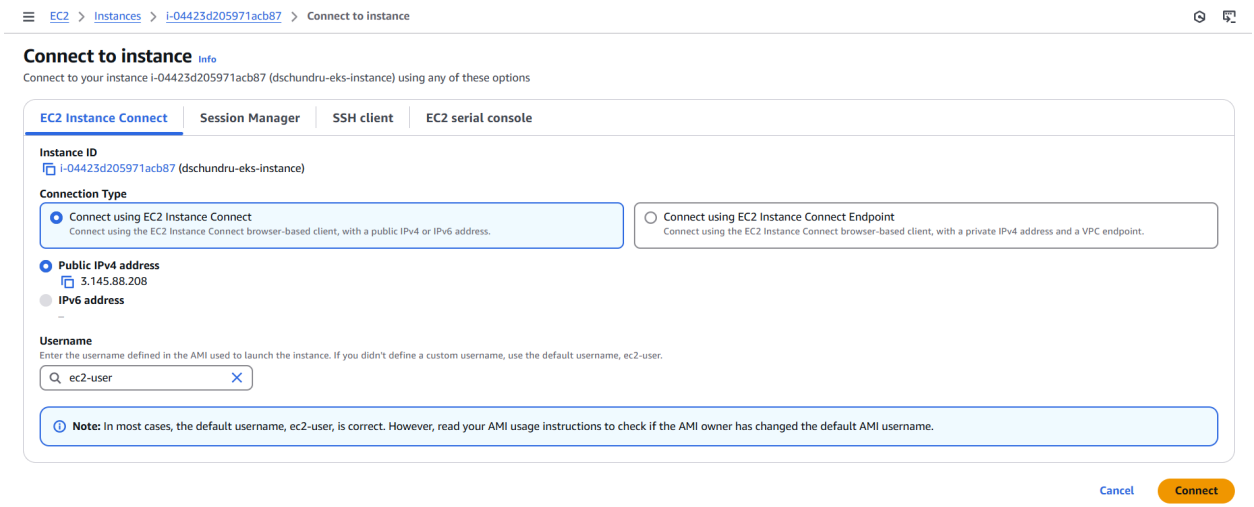


I clicked **Launch instance** to start the setup.

Once the instance appeared on the **Instances** page, I selected it and clicked **Connect**.



In the **EC2 Instance Connect** section, I used the browser-based option and clicked **Connect** again to access the instance directly.



Installed eksctl

eksctl is a command-line tool for managing Amazon EKS clusters.

I'm using eksctl because it's one of the easiest ways to create and manage EKS clusters. It saves me time by reducing the number of commands I need to run. eksctl automatically handles things like setting up networking resources, which makes the whole setup process much smoother.

I ran the following command in my EC2 instance's terminal to download, extract, and install eksctl:

```
[ec2-user@ip-172-31-9-43 ~]$ curl --silent --location "https://github.com/weaveworks/eksctl/releases/latest/do
wnload/eksctl_$(uname -s)_amd64.tar.gz" | tar xz -C /tmp
sudo mv -v /tmp/eksctl /usr/local/bin
copied '/tmp/eksctl' -> '/usr/local/bin/eksctl'
removed '/tmp/eksctl'
[ec2-user@ip-172-31-9-43 ~]$
```

- Verified that I've installed eksctl

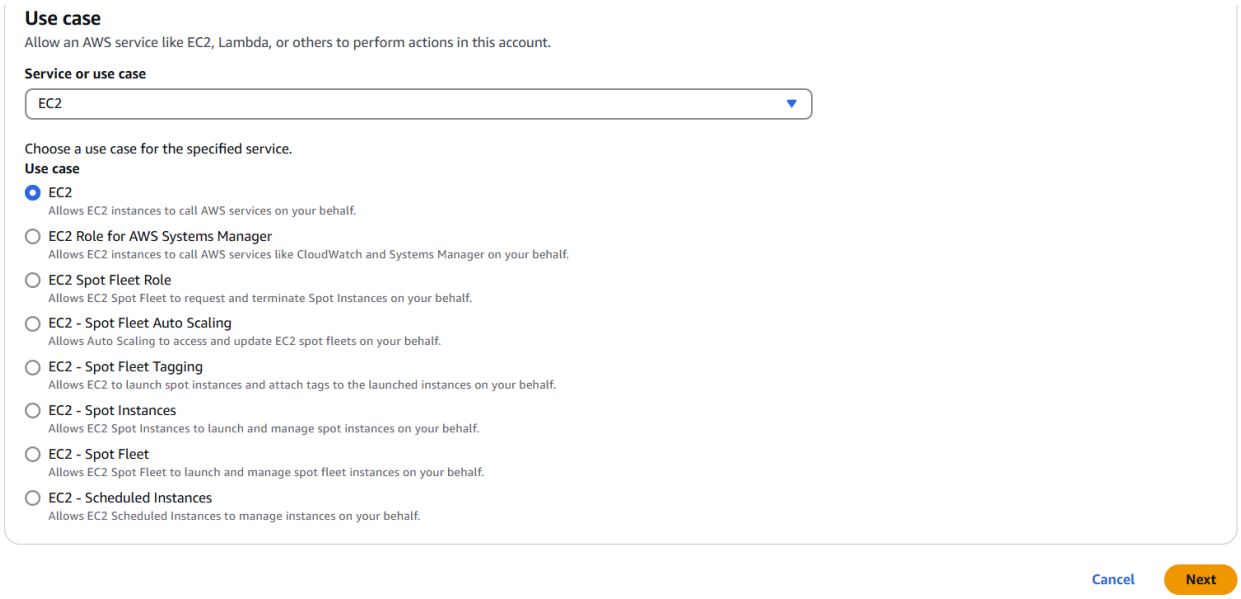
```
[ec2-user@ip-172-31-9-43 ~]$ eksctl version
0.207.0
```

Created an IAM role for my EC2 Instance

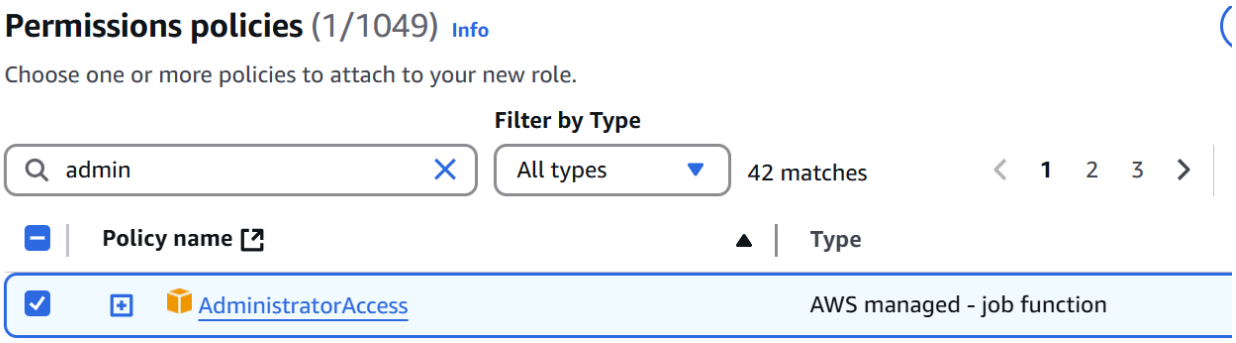
I went to the IAM console, selected **Roles**, clicked **Create role**, and chose **AWS service** as the trusted entity type for Amazon EC2.

Why do I need to set up an IAM role?

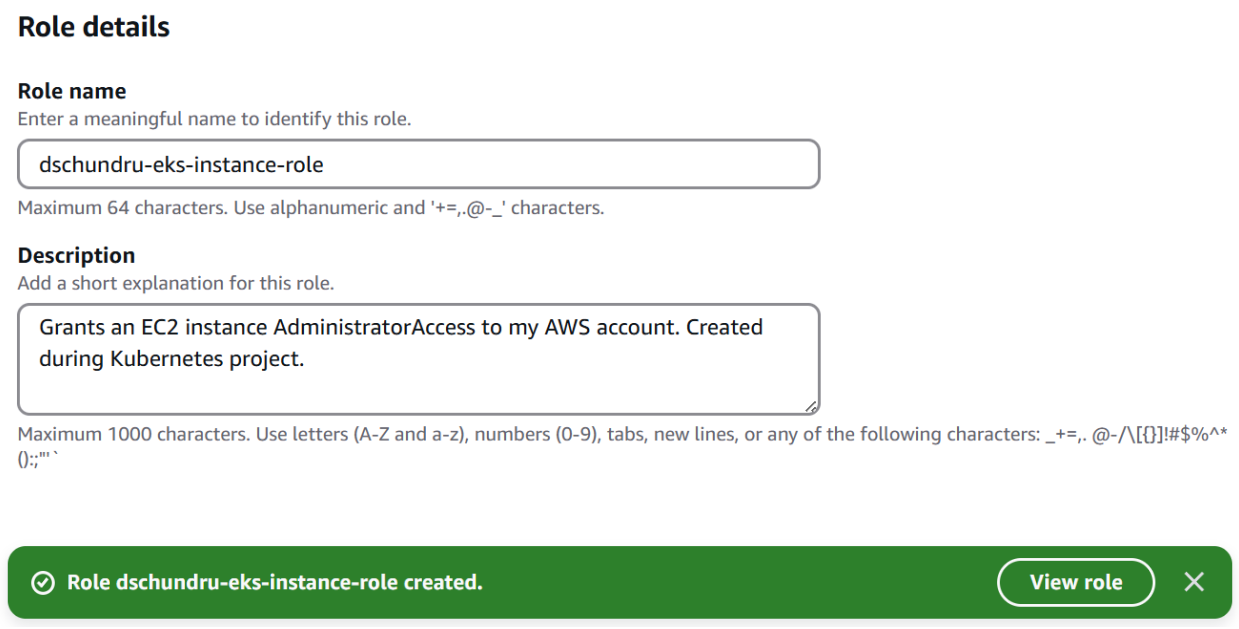
I set up an IAM role because my EC2 instance doesn't have any permissions by default. Without it, eksctl can't create EKS clusters. The role lets my instance access AWS services it needs.



- Selected **Next.** Under **Permissions policies,** I granted my EC2 instance **AdministratorAccess.**

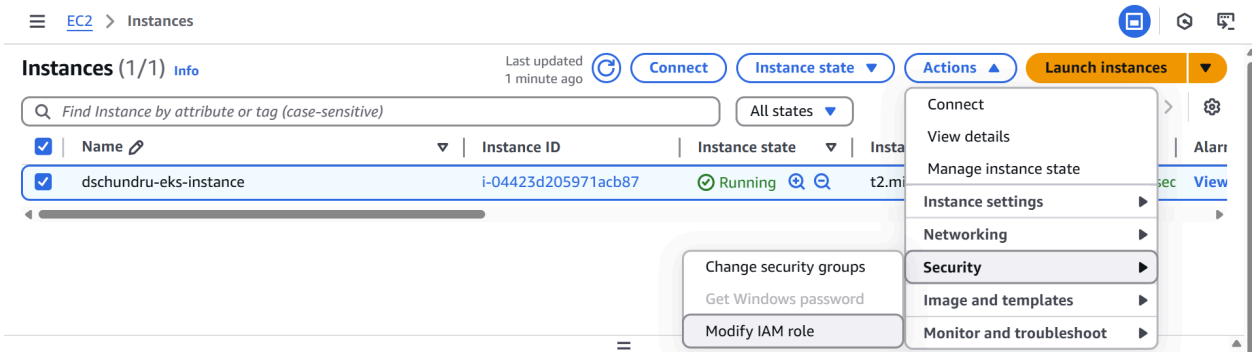


I checked AdministratorAccess, clicked Next, named the role **dschundru-eks-instance-role**, and added a short description.

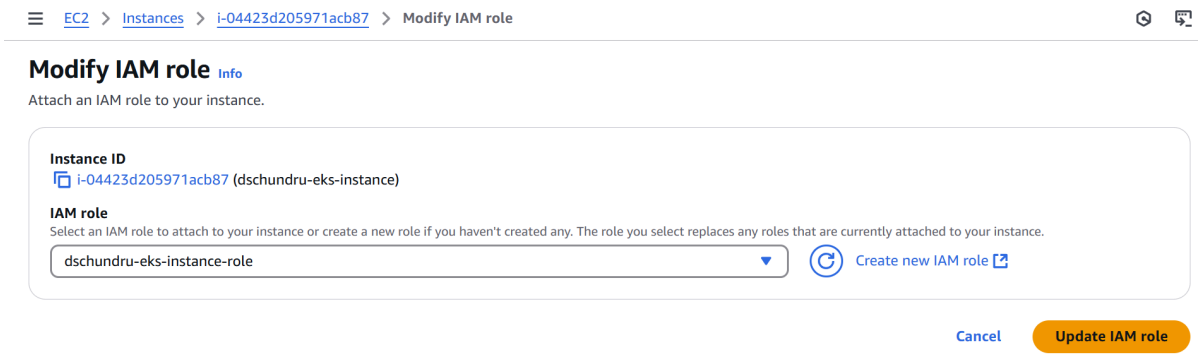


Attached IAM role to EC2 instance

I went back to the EC2 console, selected Instances, checked my dschundru-eks-instance, clicked Actions > Security > Modify **IAM role** to attach the IAM role.



Under **IAM role**, I selected my **dschundru-eks-instance-role** and clicked **Update IAM role** to attach it to the instance.

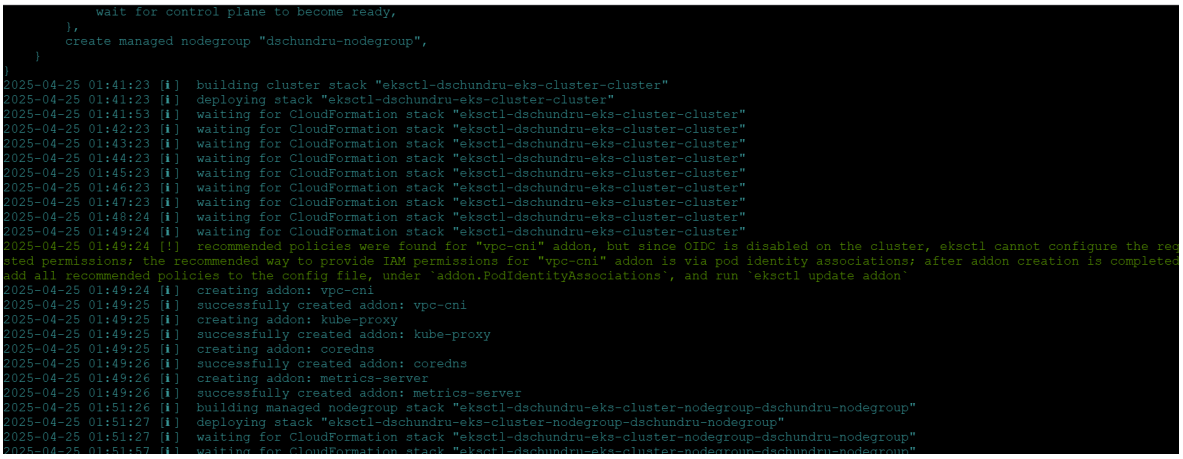


Created EKS Cluster

I headed back to EC2 Instance Connect and ran the command to create my EKS cluster, replacing **YOUR-REGION** with my region code:

```
eksctl create cluster \
--name dschundru-eks-cluster \
--nodegroup-name dschundru-nodegroup \
--node-type t2.micro \
--nodes 3 \
--nodes-min 1 \
--nodes-max 3 \
--version 1.31 \
--region us-east-2
```

```
[ec2-user@ip-172-31-9-43 ~]$ eksctl create cluster \
--name dschundru-eks-cluster \
--nodegroup-name dschundru-nodegroup \
--node-type t2.micro \
--nodes 3 \
--nodes-min 1 \
--nodes-max 3 \
--version 1.31 \
--region us-east-2
2025-04-25 01:41:23 [ℹ]  eksctl version 0.207.0
2025-04-25 01:41:23 [ℹ]  using region us-east-2
2025-04-25 01:41:23 [ℹ]  setting availability zones to [us-east-2a us-east-2c us-east-2b]
2025-04-25 01:41:23 [ℹ]  subnets for us-east-2a - public:192.168.0.0/19 private:192.168.96.0/19
2025-04-25 01:41:23 [ℹ]  subnets for us-east-2c - public:192.168.32.0/19 private:192.168.128.0/19
2025-04-25 01:41:23 [ℹ]  subnets for us-east-2b - public:192.168.64.0/19 private:192.168.160.0/19
2025-04-25 01:41:23 [ℹ]  nodegroup "dschundru-nodegroup" will use "" [AmazonLinux2/1.31]
2025-04-25 01:41:23 [ℹ]  using Kubernetes version 1.31
2025-04-25 01:41:23 [ℹ]  creating EKS cluster "dschundru-eks-cluster" in "us-east-2" region with managed nodes
2025-04-25 01:41:23 [ℹ]  will create 2 separate CloudFormation stacks for cluster itself and the initial managed nodegroup
2025-04-25 01:41:23 [ℹ]  if you encounter any issues, check CloudFormation console or try 'eksctl utils describe-stacks --region=us-east-2 --cluster=dschu
ndru-eks-cluster'
2025-04-25 01:41:23 [ℹ]  Kubernetes API endpoint access will use default of {publicAccess=true, privateAccess=false} for cluster "dschundru-eks-cluster" i
n "us-east-2"
2025-04-25 01:41:23 [ℹ]  CloudWatch logging will not be enabled for cluster "dschundru-eks-cluster" in "us-east-2"
2025-04-25 01:41:23 [ℹ]  you can enable it with 'eksctl utils update-cluster-logging --enable-types={SPECIFY-YOUR-LOG-TYPES-HERE (e.g. all)} --region=us-e
ast-2 --cluster=dschundru-eks-cluster'
2025-04-25 01:41:23 [ℹ]  default addons vpc-cni, kube-proxy, coredns, metrics-server were not specified, will install them as EKS addons
2025-04-25 01:41:23 [ℹ]
2 sequential tasks: { create cluster control plane "dschundru-eks-cluster",
    2 sequential sub-tasks: {
        2 sequential sub-tasks: {
```



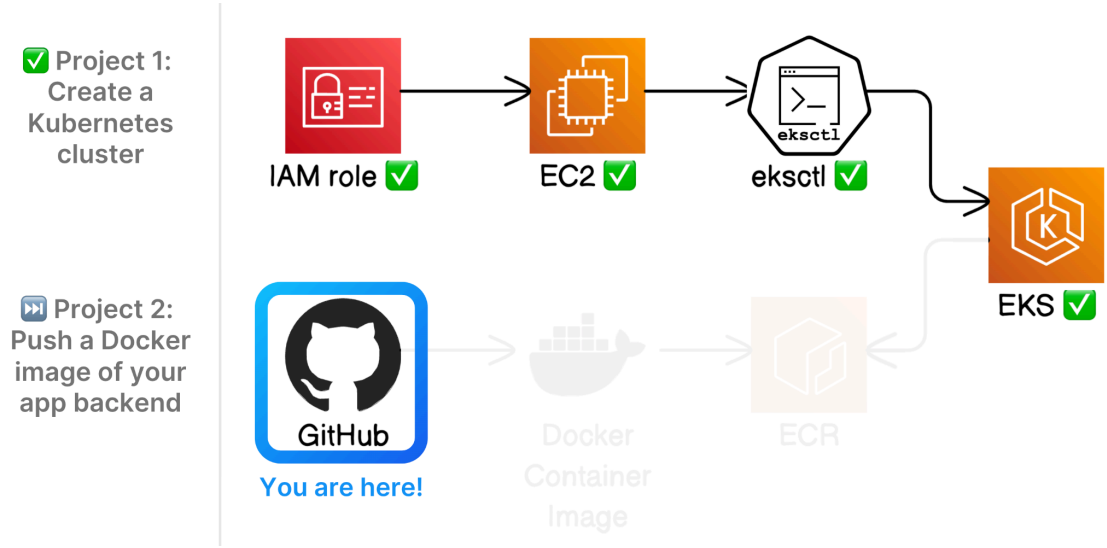
Step 2: Pull the Code for my Backend

Now that my EKS cluster is spinning up, I pulled the backend code from my team's GitHub repository.

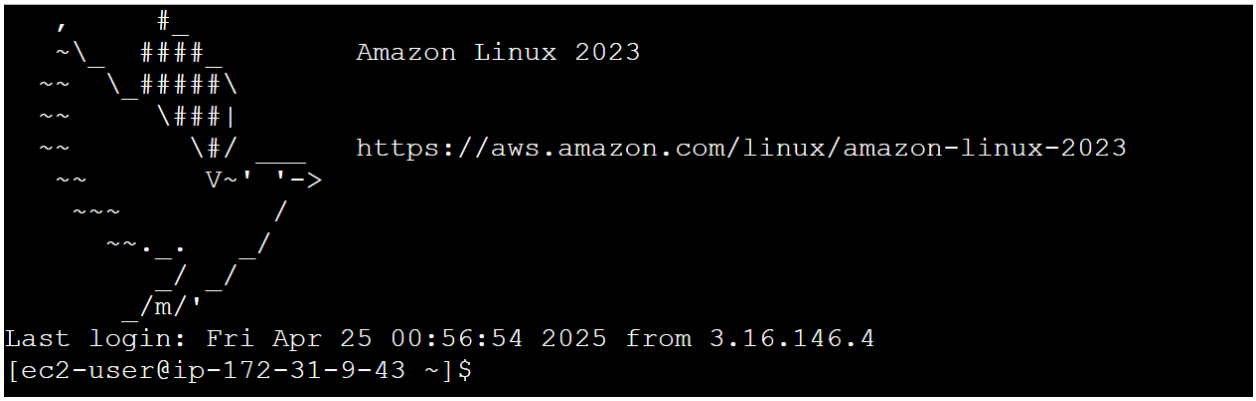
What is 'backend'?
The backend is the brain of the app; it handles requests, stores and fetches data, and makes sure everything works behind the scenes. While the frontend is what users see, the backend powers the logic and functionality.

In this step, I:

- Installed Git and cloned the application code from GitHub to my EC2 instance.



While my cluster was being created, I headed back to the EC2 console and started a new EC2 Instance Connect session with my dschundru-eks-instance-role instance.



I could connect to the same instance twice at the same time!

- It was true that I was able to open multiple SSH sessions to the same EC2 instance.

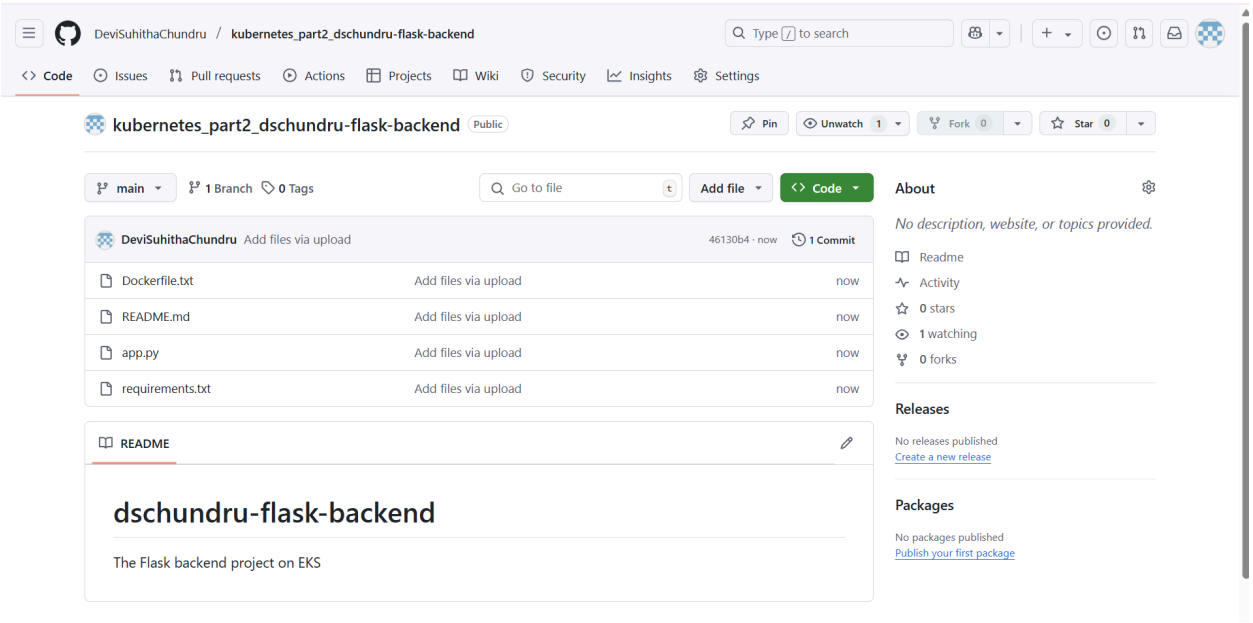
This was super helpful when I wanted to multitask or monitor logs while running commands in another session.

Let's clone my backend repository.

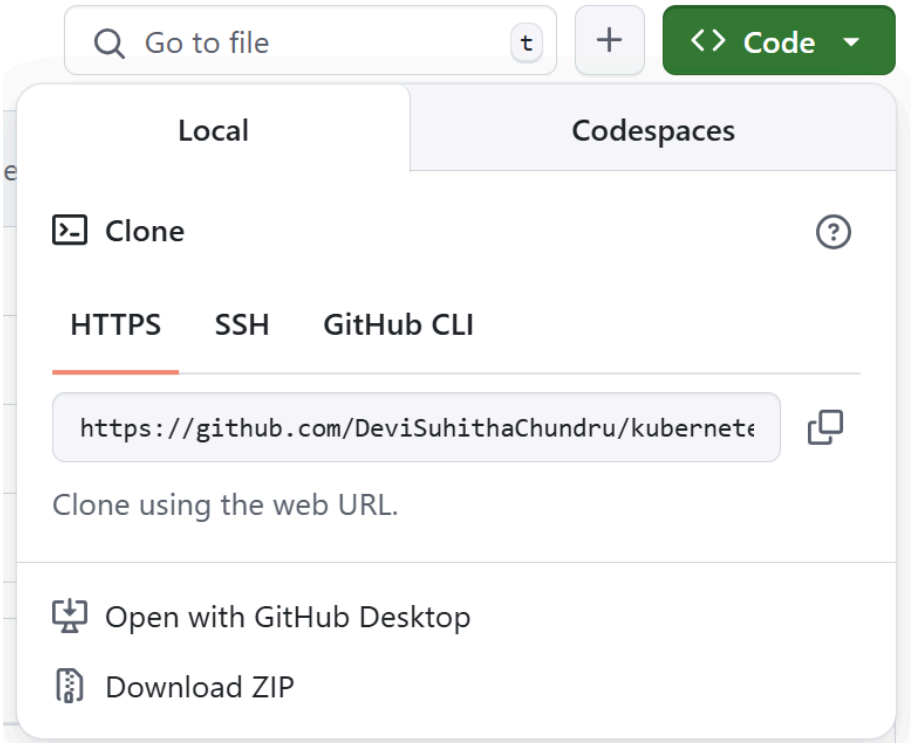
What does cloning mean?

When I say "clone a repository," I mean creating a full copy of a repository's code stored remotely (in this case, in GitHub) to my machine (in this case, our EC2 instance).

This way, I get access to all the files and code without having to manually copy and paste.



- Selected **Code** to reveal the instructions for cloning their repository and copied the **HTTPS** URL.



I headed back to my **EC2 Instance Connect** tab.

In the terminal, I ran the command below to clone the backend repository, replacing **[GITHUB-URL]** with my own GitHub repo URL:

git clone [GITHUB-URL]

```
[ec2-user@ip-172-31-9-43 ~]$ git clone https://github.com/DeviSuhithaChundru/K
ubernetes-Part-2_dschundru-flask-backend.git
-bash: git: command not found
```

What is this error about?
The terminal response "Git command not found" means I don't have **Git** installed in my EC2 instance. I need to install it first to clone a GitHub repository.

Installed Git:

```
[ec2-user@ip-172-31-9-43 ~]$ sudo dnf update
sudo dnf install git -y
```

```
Installed:
  git-2.47.1-1.amzn2023.0.2.x86_64            git-core-2.47.1-1.amzn2023.0.2.x86_64 git-core
-doc-2.47.1-1.amzn2023.0.2.noarch   perl-Error-1:0.17029-5.amzn2023.0.2.noarch
  perl-File-Find-1.37-477.amzn2023.0.6.noarch perl-Git-2.47.1-1.amzn2023.0.2.noarch perl-Ter
mReadKey-2.38-9.amzn2023.0.2.x86_64 perl-lib-0.65-477.amzn2023.0.6.x86_64

Complete!
```

- I verified that Git was installed by checking its version using the command:

```
[ec2-user@ip-172-31-9-43 ~]$ git --version
git version 2.47.1
```

I configured Git by running the following commands and replacing the placeholders with my actual name and email:

git config --global user.name "DeviSuhithaChundru"
git config --global user.email "cdevisuhitha@gmail.com"

```
[ec2-user@ip-172-31-9-43 ~]$ git config --global user.name "DeviSuhithaChundru"
git config --global user.email "cdevisuhitha@gmail.com"
```

Now I should be able to clone the repository:

```
[ec2-user@ip-172-31-9-43 ~]$ git clone https://github.com/DeviSuhithaChundru/kubernetes_part2_dschundru-flask-backend.git
Cloning into 'kubernetes_part2_dschundru-flask-backend'...
remote: Enumerating objects: 6, done.
remote: Counting objects: 100% (6/6), done.
remote: Compressing objects: 100% (6/6), done.
remote: Total 6 (delta 0), reused 0 (delta 0), pack-reused 0 (from 0)
Receiving objects: 100% (6/6), done.
[ec2-user@ip-172-31-9-43 ~]$
```

What was I Cloning?

I am cloning the kubernetes_part2_dschundru-flask-backend repository from GitHub. It has all the backend code I need, like app.py, Dockerfile, and requirements.txt.

By cloning it, I'm copying the entire project to my EC2 instance. After cloning, it will show up as a new folder with all the backend files inside, ready for me to build, run, and deploy.

I ran the **ls** command, which lists all files and folders in my current directory:

ls
This helped me confirm that a new folder named Kubernetes-Part-2_dschundru-flask-backend was successfully created in my EC2 instance after cloning the repository.

```
[ec2-user@ip-172-31-9-43 ~]$ ls
Kubernetes-Part-2_dschundru-flask-backend
```

Why does the repository name say 'flask'?

The repository name includes **"flask"** because the backend code is built using Flask, a lightweight web framework for Python. Developers use Flask to quickly create backend services or APIs.

It's called a **framework** because it provides built-in tools and templates that make it easier to handle things like HTTP requests, connect to databases, and manage routing all without having to build everything from scratch.

Step 3: Built a Container Image for My Backend

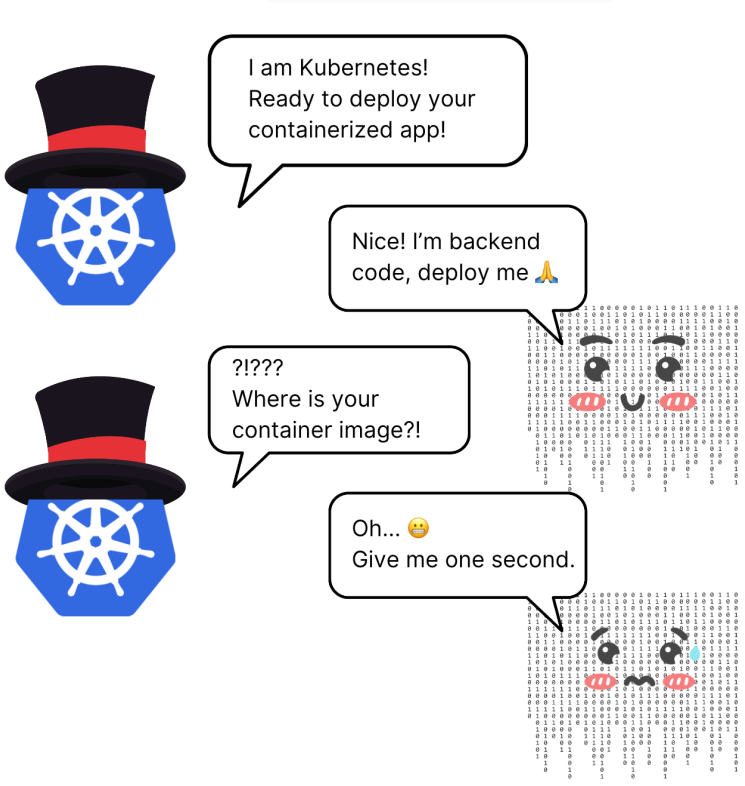
I had my backend code sitting in my EC2 instance.

On to deployment?!

When I deployed a containerized app to Kubernetes, Kubernetes needed to pull the app from a container image that it could access.

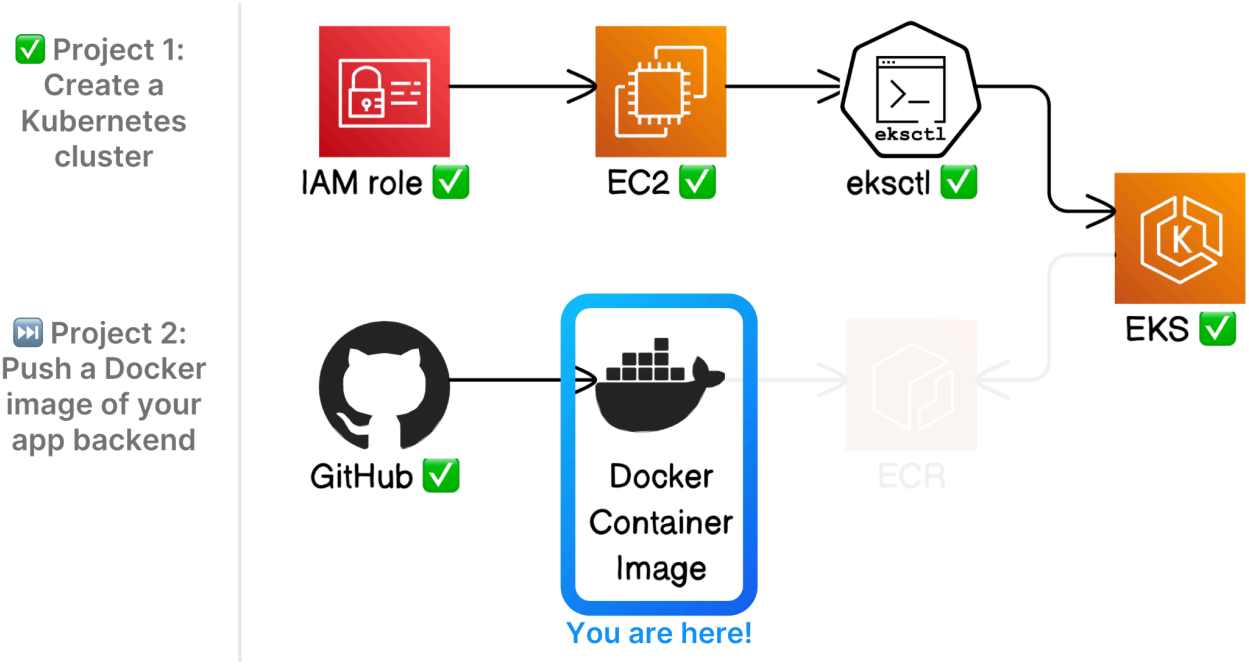
What is a container image?

A **container image** is like a blueprint that contains all the instructions, code, libraries, and dependencies needed to run the application. Note that on the other hand, a **container** is the running instance created from that image, bringing the application to life and running it in an environment.



In this step, I:

- built a container image of the backend and resolved four **installation** and **configuration errors.**



To build a **container image**, I ran the following command in my EC2 instance's terminal:

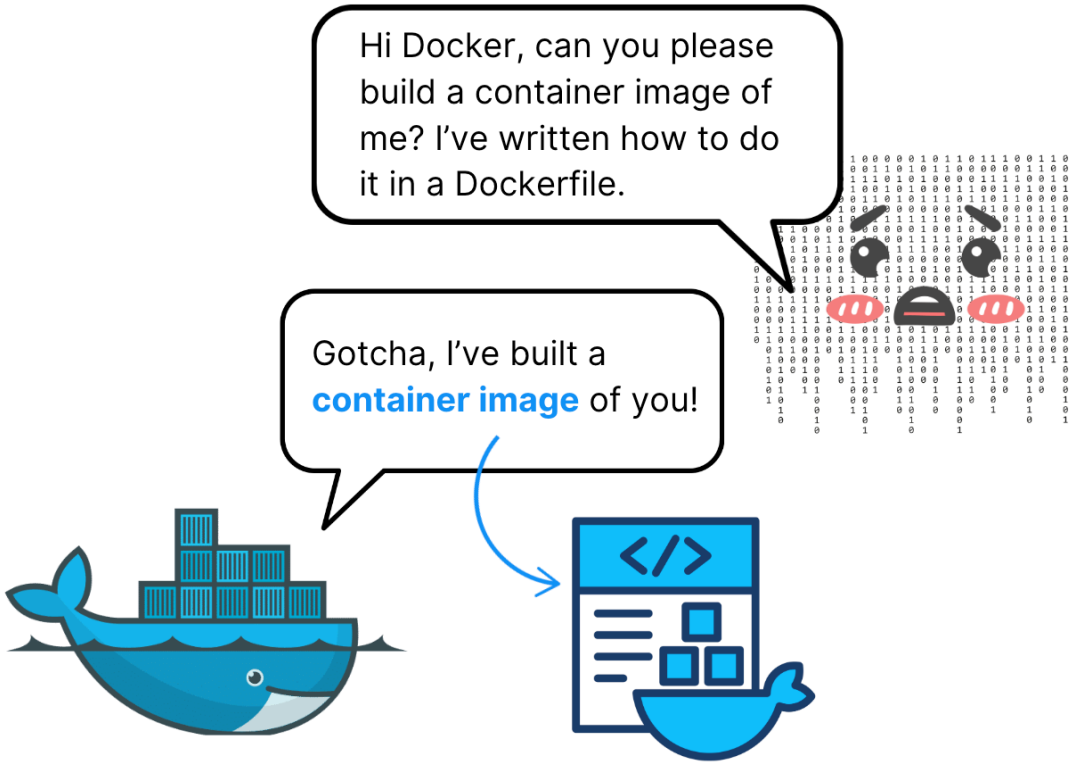
```
docker build -t kubernetes-part2_dschundru-flask-backend .
```

What did building an image mean for me?

When my team members prepared the app's backend, they included a file called a **Dockerfile** in the GitHub repository. This Dockerfile had step-by-step instructions for how to build a container image that packages the backend app along with all its dependencies.

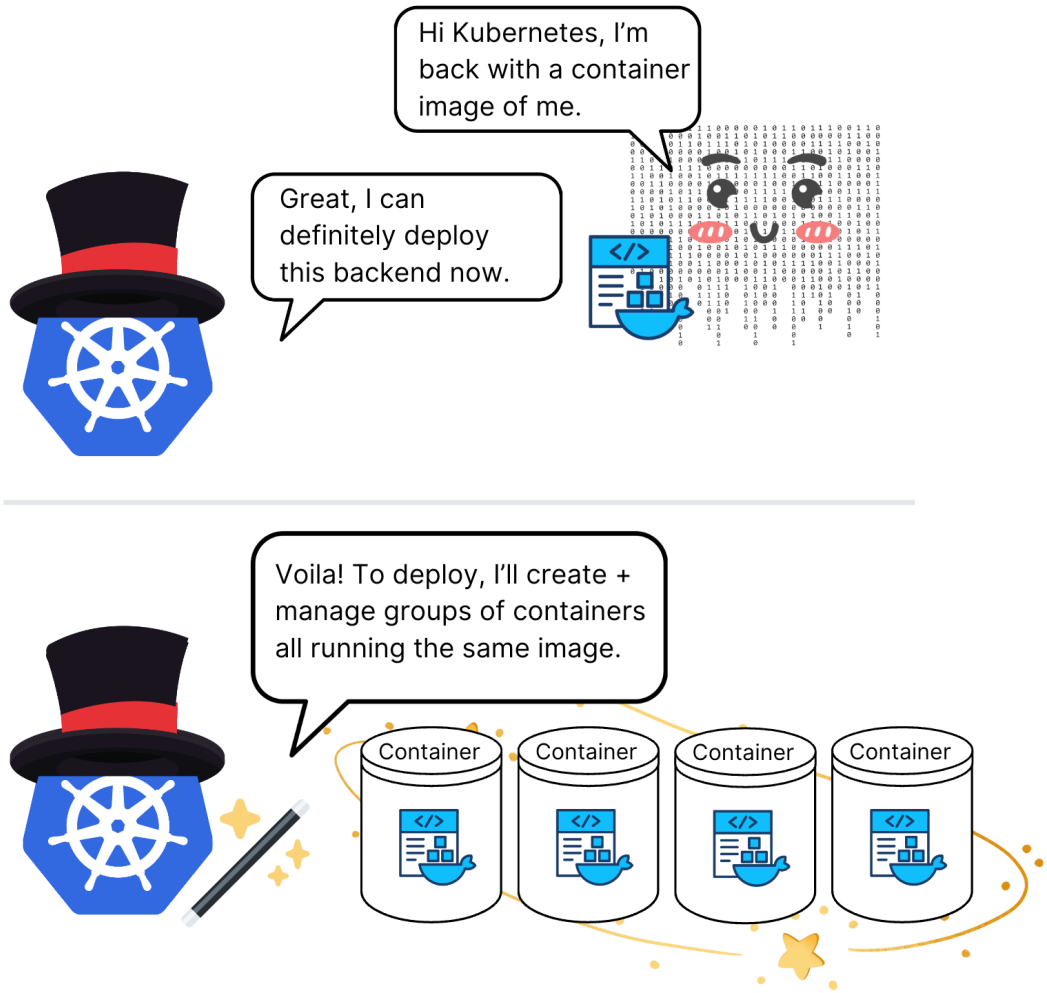
So, when I ran the **docker build** command, I was telling Docker to read those instructions and create a container image based on them. Essentially, I was generating a

portable, self-contained version of the backend that Kubernetes (or any container runtime) could run anywhere.



The container image I built allowed Kubernetes to spin up multiple, identical containers, ensuring my application ran consistently across different environments.

Whether I deployed in development, testing, or production, the app behaved the same way every time because Kubernetes used my image as the source whenever a new instance or node needed to be created.



What do these commands do?

-t Kubernetes-Part-2_dschundru-flask-backend . named my container image Kubernetes-Part-2_dschundru-flask-backend, and the (.) tells Docker to find the Dockerfile in the current directory.

An **error....!**

```
[ec2-user@ip-172-31-9-43 ~]$ docker build -t Kubernetes-Part-2_dschundru-flask-backend .
-bash: docker: command not found
[ec2-user@ip-172-31-9-43 ~]$
```

What is this error about?

Remember what a "command not found" error usually tells you?

Building a container image using Docker won't work as Docker isn't installed in my EC2 instance yet.

Installed and Configured Docker

sudo yum install -y docker

```
[ec2-user@ip-172-31-9-43 ~]$ sudo yum install -y docker
Last metadata expiration check: 11:18:11 ago on Fri Apr 25 05:04:32 2025.
Dependencies resolved.
================================================================================
================================================================
 Package                                 Architecture              Version
                      Repository                          Size
================================================================================
```

What is Docker?

Docker is the tool I'm using to **build** a container image of my backend. In general, We'd use Docker to create containers and container images, while Kubernetes coordinates multiple containers (clusters) running the same/related applications.

- **Start Docker:**

sudo service docker start

```
[ec2-user@ip-172-31-9-43 ~]$ sudo service docker start
Redirecting to /bin/systemctl start docker.service
```

Built the Docker Image

- I ran the command to build my container image again:

```
[ec2-user@ip-172-31-9-43 ~]$ docker build -t Kubernetes-Part-2_dschundru-flask
-backend .
ERROR: permission denied while trying to connect to the Docker daemon socket a
t unix:///var/run/docker.sock: Get "http://%2Fvar%2Frun%2Fdocker.sock/_ping":
dial unix /var/run/docker.sock: connect: permission denied
```

What's the error this time?

The command fails because **ec2-user**, which is the user I've used to access this instance, doesn't have permission to run Docker commands. When Docker was installed, it was set up for the **root** user.

The previous Docker commands I ran worked because they're prefixed with **sudo**, which lets a non-root user run commands with root user rights. But, it's good practice to give my ec2-user permission instead of using **sudo** each time.

Why was I logged in as ec2-user instead of the root user?

I was logged in as **ec2-user** because Amazon Linux AMIs and SSH access use it as the default user.

It's a regular user with permission to run root-level commands using **sudo**. Since Docker needs root access to build images or run containers, I used **sudo** before Docker commands to get the required privileges.

- To confirm which user I was using in the terminal, I ran: **whoami**

```
[ec2-user@ip-172-31-9-43 ~]$ whoami
ec2-user
```

Added ec2-user to the Docker group:

sudo usermod -a -G docker ec2-user

What is the Docker group?

The Docker group is a group in Linux systems that gives users the permission to run Docker commands. By default, only the root user can run Docker commands. When we add a user (e.g., ec2-user) to the Docker group, it lets that user run Docker commands without typing sudo every time.

What did this command do?

The command sudo usermod -a -G docker ec2-user added the ec2-user to the docker group.

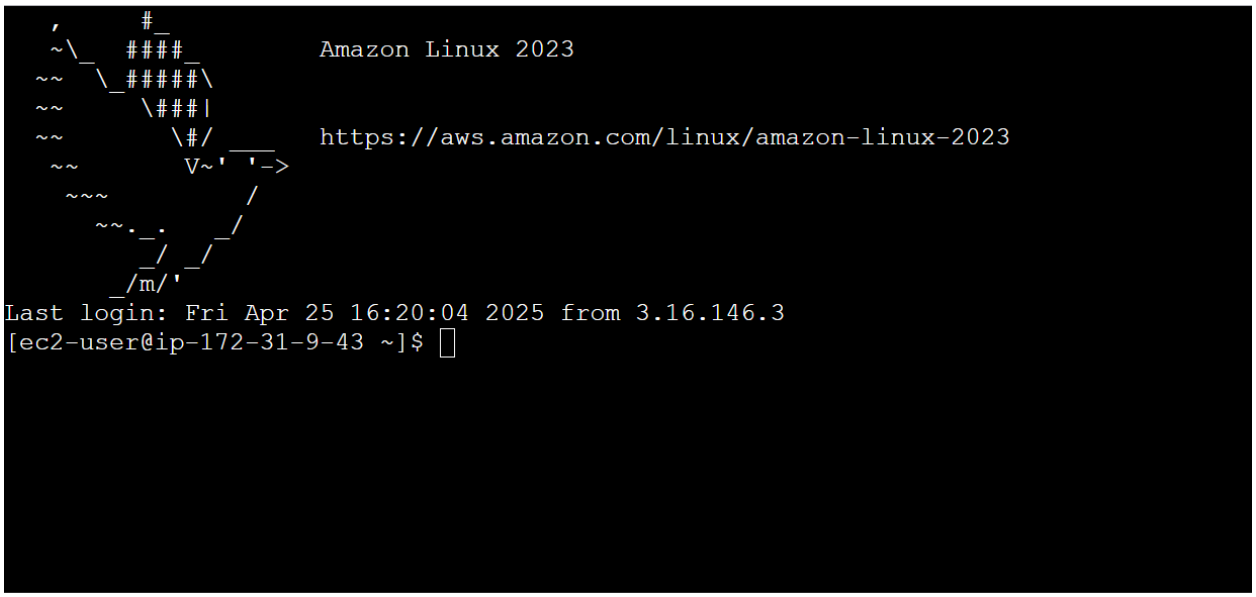
- usermod modifies user account settings like their groups, home directory, login name, and more.
- -a (append) ensures the user isn't removed from existing groups. Without -a, the user would be removed from all groups not listed in the command.
- -G specifies which group to add the user to - here, it's docker.

This allowed me to run Docker commands without needing **sudo** every time.

- Restarted my **EC2 Instance Connect** session by refreshing my current tab.

Why are we refreshing our tab?

User group changes don't take effect until I start a new session, so reconnecting to my EC2 instance makes sure my **ec2-user** picks up the new docker group permissions.



- Make sure my ec2-user has been added to the Docker group:

groups ec2-user

What does this command do?

This command will list all the groups that ec2-user is a part of.

If I see docker listed, then ec2-user is in the Docker group and can run Docker commands without using sudo.

```
[ec2-user@ip-172-31-9-43 ~]$ groups ec2-user
ec2-user : ec2-user adm wheel systemd-journal docker
[ec2-user@ip-172-31-9-43 ~]$
```

- Yes, I could run the Docker build command again by pressing the **up arrow (↑)** on my keyboard to cycle through my recent terminal commands until the build command appeared:

```
[ec2-user@ip-172-31-9-43 ~]$ docker build -t kubernetes_part2_dschundru-flask-backend .
[+] Building 0.1s (1/1) FINISHED                                        docker:default
 => [internal] load build definition from Dockerfile                             0.0s
 => => transferring dockerfile: 2B                                               0.0s
ERROR: failed to solve: failed to read dockerfile: open Dockerfile: no such file or director
y
[ec2-user@ip-172-31-9-43 ~]$
```

Ooof, another error!

Yup! My command won't work because my terminal needs a Dockerfile to build a container image, but it can't seem to find one right now..

What were the results telling me ?

The terminal showed the directories and files in my EC2 instance's root directory.

I saw a folder called kubernetes_part2_dschundru-flask-backend**,** which is the cloned GitHub repository containing the backend code and Dockerfile.

To build the Docker image, I needed to move into the kubernetes_part2_dschundru-flask-backend folder, or Docker wouldn't find the Dockerfile needed to create the image.

To **build my Docker image**, I first needed to navigate into the application directory that had the Dockerfile.

I did this by running:

cd kubernetes_part2_dschundru-flask-backend

- I ran **ls** inside kubernetes_part2_dschundru-flask-backend to see the Dockerfile and backend files.

```
[ec2-user@ip-172-31-9-43 kubernetes_part2_dschundru-flask-backend]$ ls
Dockerfile  README.md  app.py  kubernetes_part2_dschundru-flask-backend  requirements.txt
```

- I ran docker build -t kubernetes_part2_dschundru-flask-backend . to build the Docker image again.

```
[ec2-user@ip-172-31-9-43 kubernetes_part2_dschundru-flask-backend]$ docker build -t  kubernetes_part2_dschundru-flask-backend .
[+] Building 11.1s (10/10) FINISHED                                                                    docker:default
 => [internal] load build definition from Dockerfile                                                           0.0s
 => => transferring dockerfile: 281B                                                                           0.0s
 => [internal] load metadata for docker.io/library/python:3.9-alpine                                           0.4s
 => [internal] load .dockerignore                                                                              0.0s
 => => transferring context: 2B                                                                                0.0s
 => [1/5] FROM docker.io/library/python:3.9-alpine@sha256:c549d512f8a56f7dbf15032c0b21799f022118d4b7254        1.7s
 => => resolve docker.io/library/python:3.9-alpine@sha256:c549d512f8a56f7dbf15032c0b21799f022118d4b7254        0.0s
 => => sha256:f18232174bc91741fdf3da96d85011092101a032a93a388b79e99e69c2d5c870 3.64MB / 3.64MB                 0.2s
 => => sha256:31050cb47a0204aa139821ee500ed6b13dc7142d89b12154f9a2d2efba8a6ab7 460.18kB / 460.18kB             0.3s
 => => sha256:374b62c84664db7f5059aa54735d1e7921d3350b69515a1c9651201795807c3d 14.87MB / 14.87MB               0.4s
 => => sha256:c549d512f8a56f7dbf15032c0b21799f022118d4b72542b8d85e2eae350cfcd7 10.29kB / 10.29kB               0.0s
 => => sha256:920c6d2e0859e15c81b84b28964b7a47771d593f1bbcc0d993fbf39c6f8b050f 1.73kB / 1.73kB                 0.0s
 => => sha256:3f2234415a3570fc933cd711b6baf7b905d0c6367cf747af84dbf9fbee642b10 5.08kB / 5.08kB                 0.0s
 => => extracting sha256:f18232174bc91741fdf3da96d85011092101a032a93a388b79e99e69c2d5c870                      0.3s
 => => sha256:4facdbdcc8a37a46035340540047c8eed35e9b8dfd033632e0438d03f82d021a 250B / 250B                     0.3s
 => => extracting sha256:31050cb47a0204aa139821ee500ed6b13dc7142d89b12154f9a2d2efba8a6ab7                      0.1s
 => => extracting sha256:374b62c84664db7f5059aa54735d1e7921d3350b69515a1c9651201795807c3d                      0.8s
 => => extracting sha256:4facdbdcc8a37a46035340540047c8eed35e9b8dfd033632e0438d03f82d021a                      0.0s
 => [internal] load build context                                                                              0.1s
 => => transferring context: 83.03kB                                                                           0.0s
```

```
i-04423d205971acb87 (dschundru-eks-instance)
PublicIPs: 3.145.88.208  PrivateIPs: 172.31.9.43
```

Step 4: Pushed My Container Image to Amazon ECR

Now that my container image is all built, where should Kubernetes find my container image?

Container registries, like **Amazon Elastic Container Registry (ECR),** are storage spaces for container images. They give container images somewhere to live so they can be accessed by Kubernetes/other services.

Why am I using Docker and ECR?

I'm using Docker to package up the backend and then pushing that container image to Amazon ECR (Elastic Container Registry). When it's time for Kubernetes to deploy my application, Kubernetes can just pull the image directly from ECR.

This setup is the standard way for deploying containerized apps with Kubernetes (instead of deploying code on my local machine) because it helps with consistency and scaling.

In this step, I:

- Stored the Docker image of my backend in ECR.

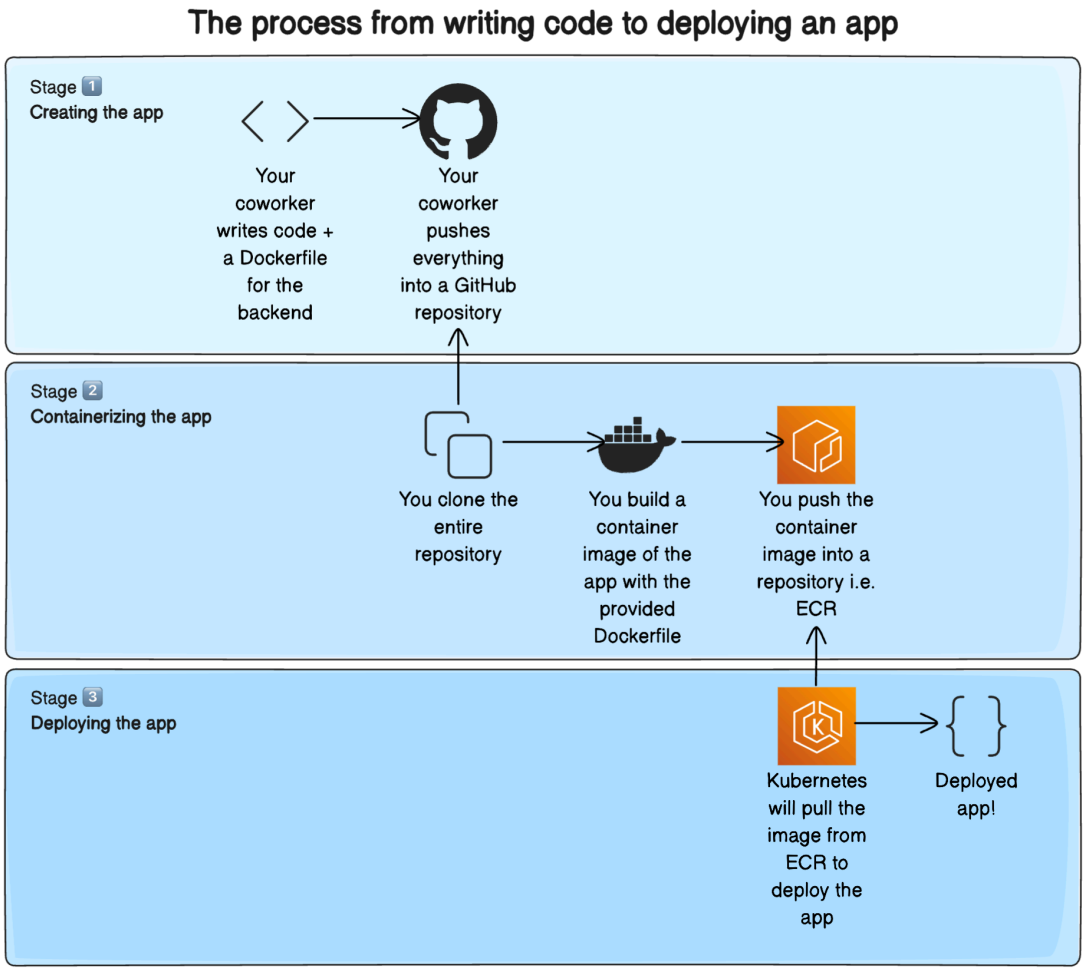
Created a new Amazon ECR repository using this command:

```
aws ecr create-repository \
  --repository-name kubernetes_part2_dschundru-flask-backend \
  --image-scanning-configuration scanOnPush=true \
```

Why am I using ECR?

Amazon ECR (Elastic Container Registry) is a container registry service by AWS, which means I use it to securely store, share, and deploy container images.

ECR is an excellent choice for storing my container image because it's an AWS service, which lets Elastic Kubernetes Service (EKS) deploy my container image with minimal authentication setup.




```
[ec2-user@ip-172-31-9-43 ~]$ aws ecr create-repository \
  --repository-name kubernetes_part2_dschundru-flask-backend \
  --image-scanning-configuration scanOnPush=true \
{
    "repository": {
        "repositoryArn": "arn:aws:ecr:us-east-2:329599620395:repository/kubernetes_part2_dschundru-flask-backend",
        "registryId": "329599620395",
        "repositoryName": "kubernetes_part2_dschundru-flask-backend",
        "repositoryUri": "329599620395.dkr.ecr.us-east-2.amazonaws.com/kubernetes_part2_dschundru-flask-backend",
        "createdAt": "2025-04-25T20:50:08.857000+00:00",
        "imageTagMutability": "MUTABLE",
        "imageScanningConfiguration": {
            "scanOnPush": true
        },
        "encryptionConfiguration": {
            "encryptionType": "AES256"
        }
    }
}
[ec2-user@ip-172-31-9-43 ~]$
```

i-04423d205971acb87 (dschundru-eks-instance)

PublicIPs: 3.145.88.208 PrivateIPs: 172.31.9.43

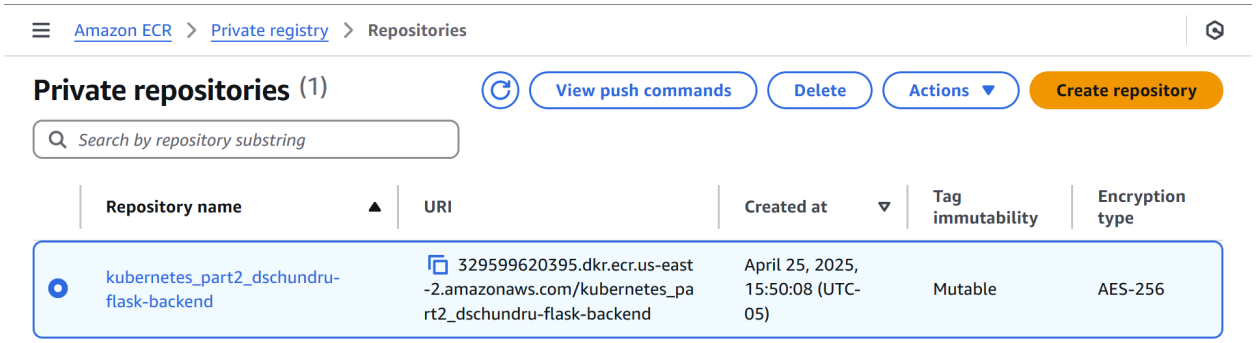
What does the terminal's response mean?

This response confirms that my ECR repository has been created - it's ready for me to push Docker images!

Here's a breakdown of the terminal response

- **repositoryArn:** The Amazon Resource Name (ARN) i.e. unique ID for my ECR repository.
- **repositoryUri:** This is the URL I'll use to push and pull container images. It shows where my images will be stored.
- **repositoryName:** The name I've given to my repository in this case, kubernetes_part2_dschundru-flask-backend.
- **imageTagMutability:** Whether image tags are mutable or immutable. "MUTABLE" means I can overwrite which image has a tag e.g. the latest tag can be taken by a newer image at any time.
- **imageScanningConfiguration:** Whether images will be scanned for vulnerabilities when pushed.
- **encryptionConfiguration:** My images are encrypted using AES256 for security.

I opened a new tab, go to the ECR console, and confirmed that a new repository called **kubernetes_part2_dschundru-flask-backend** was created.



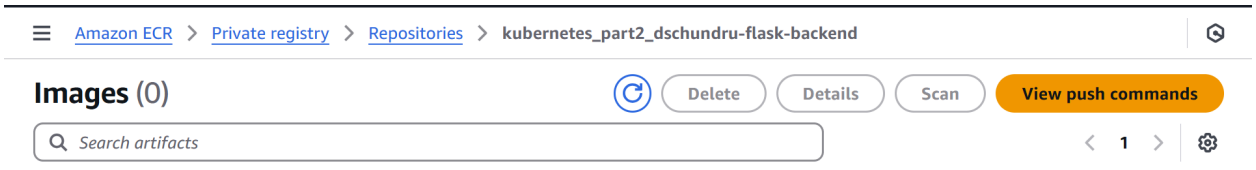
Nice, my Amazon ECR repository was live. I was ready to push my container image into ECR!

Pushed my container image to ECR

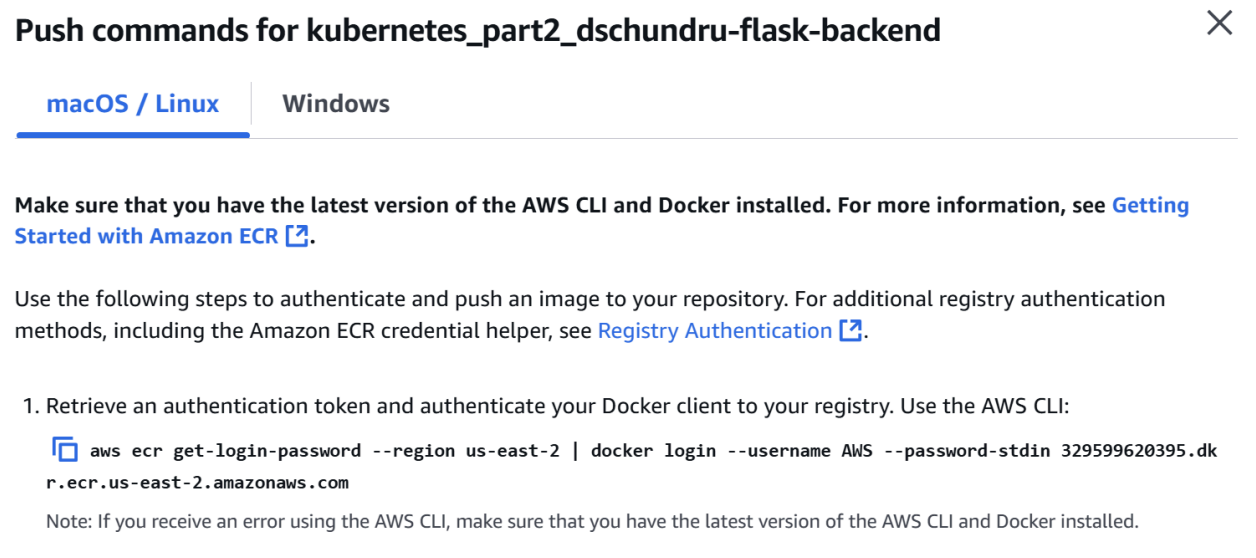
- I selected my new repository and clicked **View push commands**.

What is a push command?

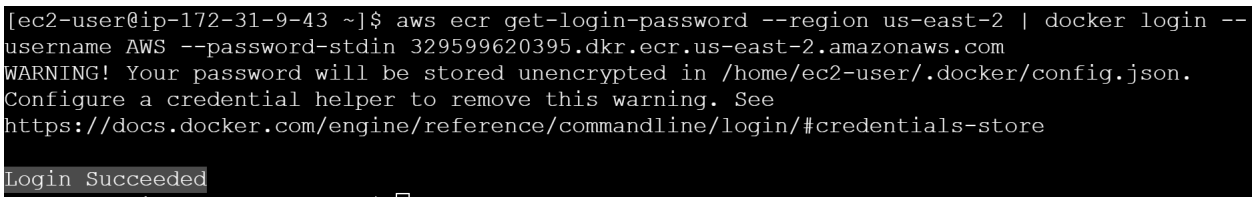
A push command in Amazon ECR is used to upload our Docker container images to an ECR repository.



- I copied the first command.



- I ran the command in my EC2 Instance Connect window.



I headed back to my ECR console's push commands window. Since I had already built my container image, I skipped the second command.

I copied the **last two** push commands.

2. Build your Docker image using the following command. For information on building a Docker file from scratch see the instructions here. You can skip this step if your image is already built:

   ```
   docker build -t kubernetes_part2_dschundru-flask-backend .
   ```

3. After the build completes, tag your image so you can push the image to this repository:

   ```
   docker tag kubernetes_part2_dschundru-flask-backend:latest 329599620395.dkr.ecr.us-east-2.amazonaws.com/kubernetes_part2_dschundru-flask-backend:latest
   ```

4. Run the following command to push this image to your newly created AWS repository:

   ```
   docker push 329599620395.dkr.ecr.us-east-2.amazonaws.com/kubernetes_part2_dschundru-flask-backend:latest
   ```

- I ran the last two in my EC2 Instance Connect terminal to tag and push my container image.

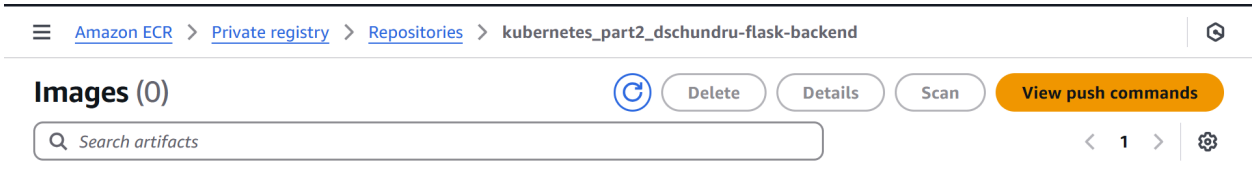
```
[ec2-user@ip-172-31-9-43 ~]$ docker tag kubernetes_part2_dschundru-flask-backend:latest 329599620395.dkr.ecr.us-east-2.amazonaws.com/kubernetes_part2_dschundru-flask-backend:latest
[ec2-user@ip-172-31-9-43 ~]$ docker push 329599docker push 329599620395.dkr.ecr.us-east-2.amazonaws.com/kubernetes_part2_dschundru-flask-backend:latest
The push refers to repository [329599620395.dkr.ecr.us-east-2.amazonaws.com/kubernetes_part2_dschundru-flask-backend]
78744ade330f: Pushed
9ad59d572c60: Pushed
340dfe38e033: Pushed
acd9d20cc5d9: Pushed
145d798cd760: Pushed
55e198163324: Pushed
98478a764fb3: Pushed
08000c18d16d: Pushed
latest: digest: sha256:5971ee65c4dfe01556d2a683800c01f09dd9609c273c368862b9211dfee2001d size: 1991
[ec2-user@ip-172-31-9-43 ~]$
```

What do tagging and pushing the image do?

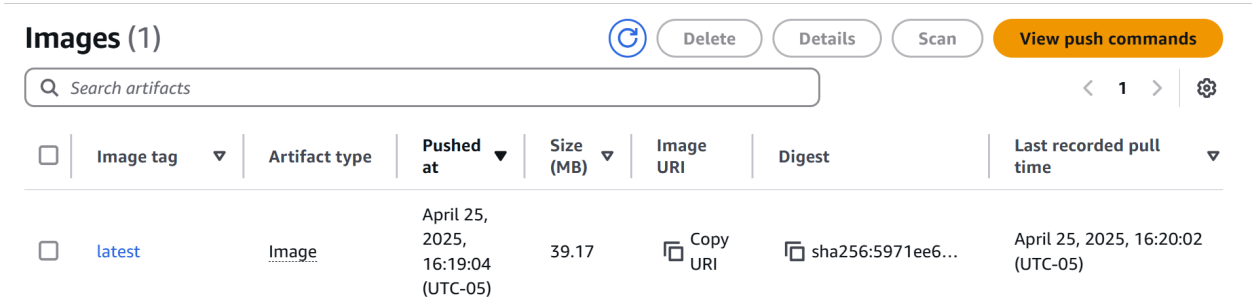
Since my ECR repository can hold many versions of the same container image, tags help me keep things organized. Tagging my Docker image is like giving it a nickname so I can easily refer to a specific version.

Here, I'm **tagging** my Docker image with the latest so Kubernetes knows where it can find the right container image version when it's time to deploy. **Pushing** uploads the tagged image to a remote repository. In my case, I've just uploaded my container image to my ECR repository!

- I headed back to the ECR console, closed the push commands window, and clicked the refresh button to update my console.



- Confirmed that a new container image is in my console now.



Does Kubernetes only run containerized applications from a repository?

No, Kubernetes doesn't have to pull images from a repository but using one like ECR makes things easier.

- **With a registry,** Kubernetes can pull the latest image automatically across all nodes.
- **Without a registry**, I would have to manually load and update the image on every node.

Secret Mission: Dive into the Backend Code

To explore the backend repository I cloned. By the end of this project, I'll truly know what was inside the Docker image I built and pushed in this project.

In this secret mission, I:

- Opened the backend repository on GitHub.
- Explore the three files that make up the backend.
- Showcased my secret mission in my project documentation.

My team member sent me a link to Search Hacker News and asked me to search for something.

- I typed a keyword and hit enter.

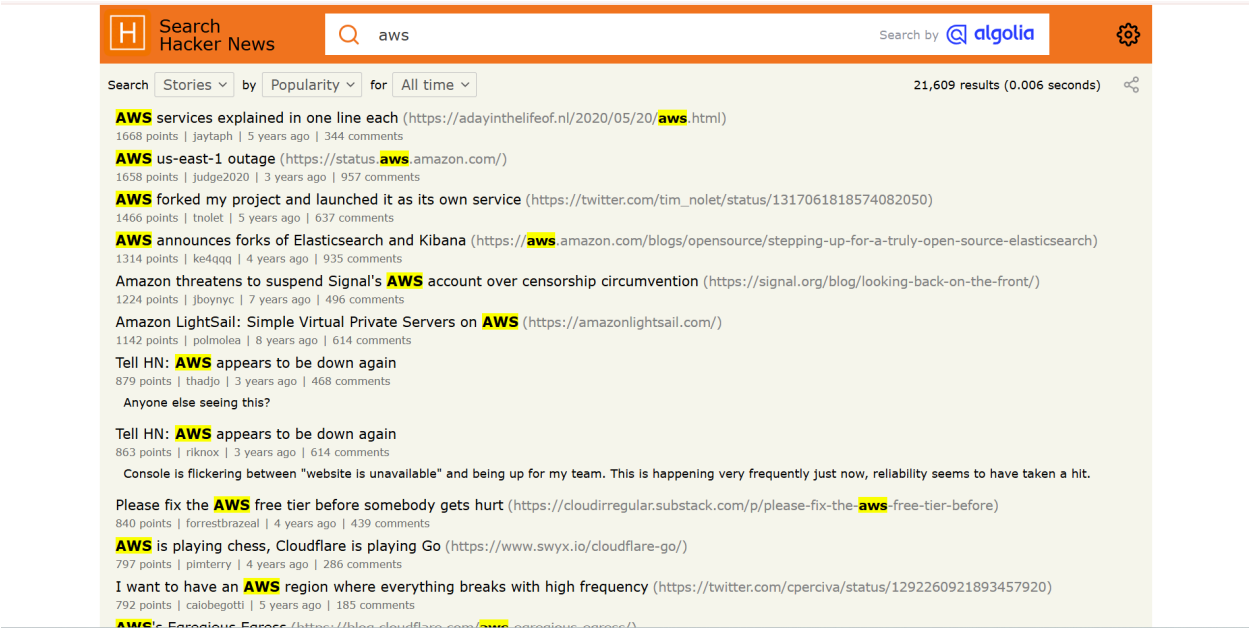
The backend received my request, found the matching articles, and sent them back to me so I could see the results.

What is Search Hacker News?

Hacker News is an online platform and community where we can read and discuss tech-related news and industry trends.

Search Hacker News is the Hacker News platform's search engine. I'd use it to quickly find relevant content based on my search terms.

- I opened this link to Search Hacker News in a new tab, which already has the search query aws pre-filled: https://hn.algolia.com/?q=aws



My coworker explained that the backend app was a tool that:

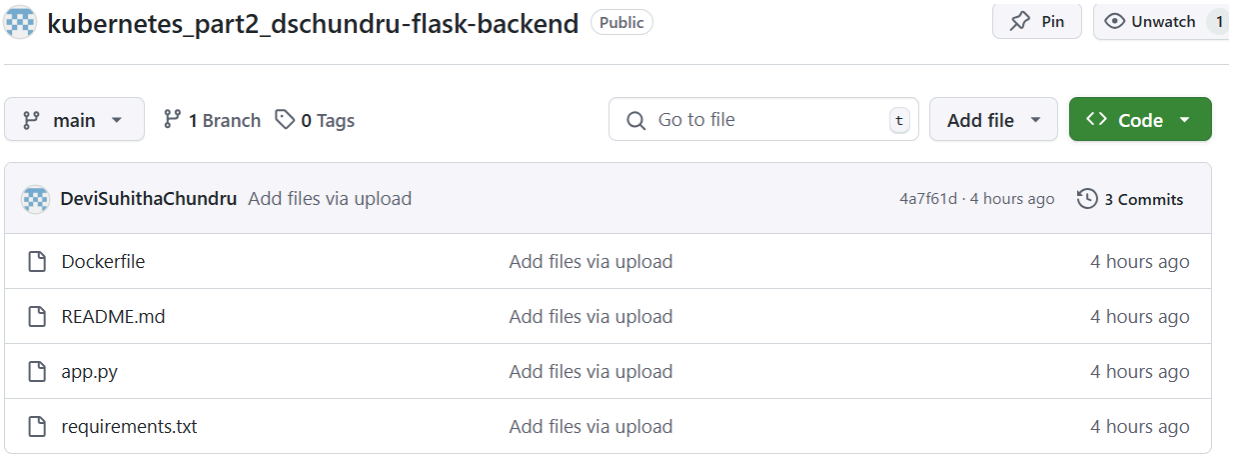
- Took my input (for example, "aws")
- Ran it as a search query in Hacker News Search
- Processed the search results and formatted them into JSON data

Even though I hadn't seen the backend's JSON output yet (because I hadn't deployed it), using Search Hacker News gave me a good idea of the kind of data the backend would produce.

Next part (answering "How does the backend code do all this?") simply:
👉 The backend code sent my input to Hacker News Search, collected the results, cleaned them up, and organized them into a neat JSON format.

ExploreD the Code

- Open the backend GitHub repository in my browser.



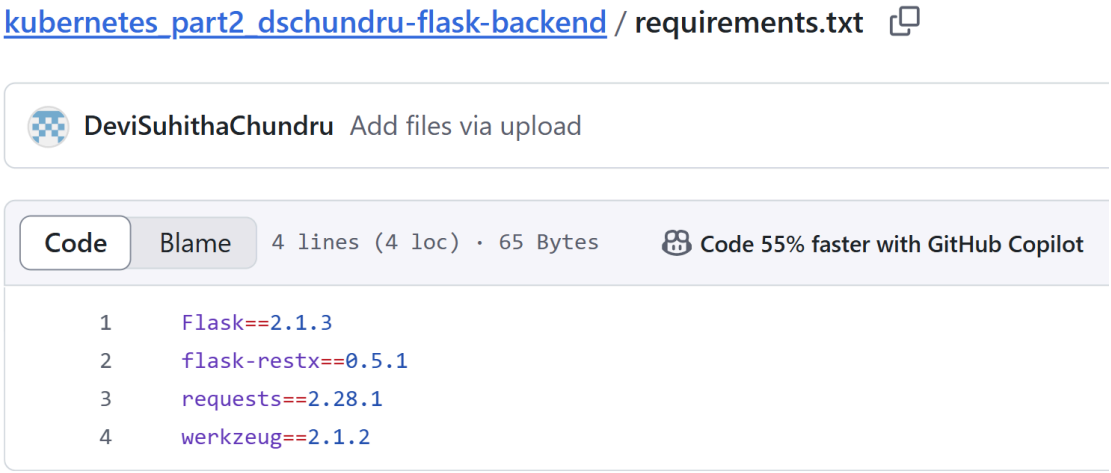
What's in this GitHub repository?

This GitHub repository holds all the source code for your app's backend.

There are three main characters in your backend app's code:

- **requirements.txt** lists the dependencies my app needs.
- The **Dockerfile** provides a set of instructions for building a Docker image for my app.
- **app.py** is the core of my backend. It contains the actual code that determines what my app does and the kind of responses it sends back to the client.

Look at **requirements.txt**. This file lists the dependencies my application needs to run properly.



Can I break down the dependencies in requirements.txt?

- Flask==2.1.3: **Flask** is the web framework used to build the backend code, which I would see in **app.py.**
- flask-restx==0.5.1: My app creates an **API** using an extension **Flask-RESTx** so that users or other applications can make requests to our backend.
- requests==2.28.1: The **Requests** library is used to get data from the Hacker News **API**.
- werkzeug==2.1.2: **Werkzeug** helps Flask handle application-level routing. For example, when a user/service makes a request to my backend, Flask uses its routing system (powered by Werkzeug) to direct that request to the right.

Selected the **Dockerfile**.

kubernetes_part2_dschundru-flask-backend / Dockerfile

DeviSuhithaChundru Add files via upload

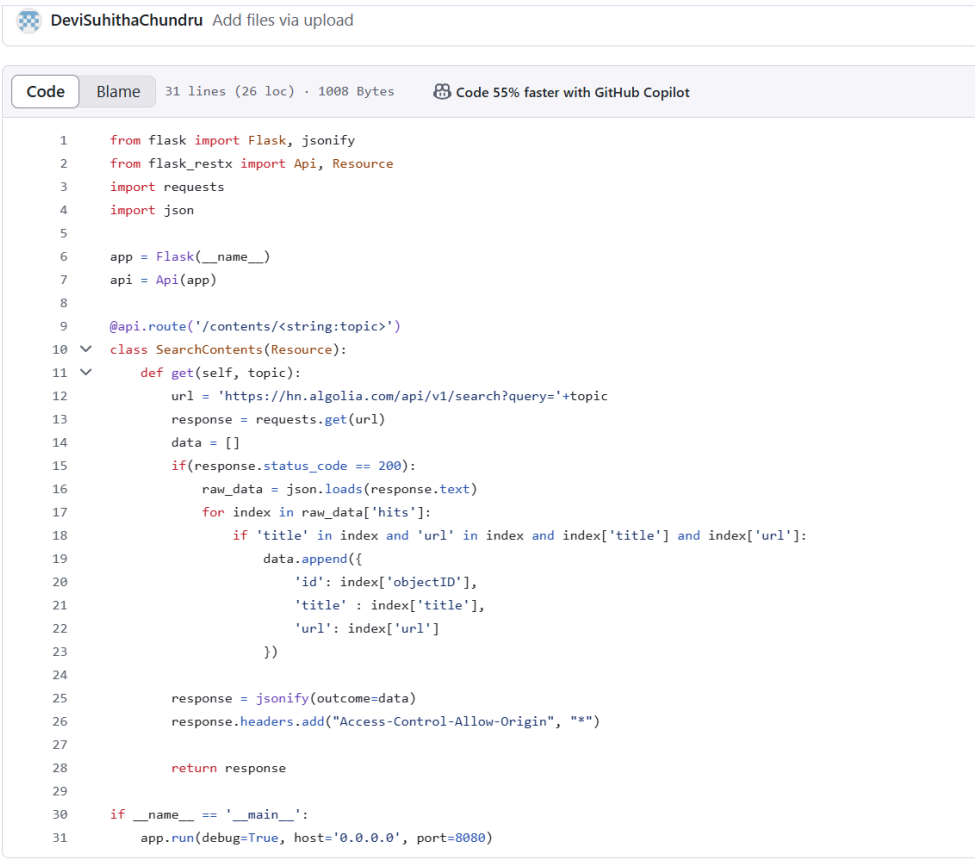
Code | Blame | 7 lines (7 loc) · 183 Bytes | Code 55% faster with GitHub Copilot

```
1  FROM python:3.9-alpine
2  LABEL Author="Devi Suhitha Chundru"
3  WORKDIR /app
4  COPY requirements.txt requirements.txt
5  RUN pip3 install -r requirements.txt
6  COPY . .
7  CMD ["python3", "app.py"]
```

Can I break down the commands in this Dockerfile?

- **FROM python:3.9-alpine** — I set up the environment by using Python 3.9 on Alpine Linux, which kept my app small and fast.
- **LABEL Author="NextWork"** — I added author information to the image.
- **WORKDIR /app** — I set **/app** as the working directory where the next commands would run.
- **COPY requirements.txt requirements.txt** — I copied the **requirements.txt** file from my local machine into the container.
- **RUN pip3 install -r requirements.txt** — I installed all the dependencies listed in **requirements.txt**.
- **COPY . .** — I copied all my project files (like **requirements.txt** and **app.py**) into the container's **/app** directory.
- **CMD ["python3", "app.py"]** — I told the container to run **python3 app.py** to start my Flask app.

Now selected **app.py**.



DeviSuhithaChundru Add files via upload

Code | Blame | 31 lines (26 loc) · 1008 Bytes | Code 55% faster with GitHub Copilot

```python
from flask import Flask, jsonify
from flask_restx import Api, Resource
import requests
import json

app = Flask(__name__)
api = Api(app)

@api.route('/contents/<string:topic>')
class SearchContents(Resource):
    def get(self, topic):
        url = 'https://hn.algolia.com/api/v1/search?query='+topic
        response = requests.get(url)
        data = []
        if(response.status_code == 200):
            raw_data = json.loads(response.text)
            for index in raw_data['hits']:
                if 'title' in index and 'url' in index and index['title'] and index['url']:
                    data.append({
                        'id': index['objectID'],
                        'title' : index['title'],
                        'url': index['url']
                    })

        response = jsonify(outcome=data)
        response.headers.add("Access-Control-Allow-Origin", "*")

        return response

if __name__ == '__main__':
    app.run(debug=True, host='0.0.0.0', port=8080)
```

What's happening in app.py?

app.py is the main code for my backend. It has three main parts:

- **Setting up the app and routing:** The code starts by importing the Flask framework and tools for creating an API. It defines a route (/contents/<topic>) that directs incoming requests to the SearchContents class. This means users visiting my backend will need to visit a URL that ends with /contents/<topic> to see any results
- **Fetching data:** In the **SearchContents** class, the get() method extracts the topic from the URL, sends a request to the Hacker News Search API to find related content, and collects important details like id, title, and url.
- **Sending the response:** The collected data is turned into a formatted JSON response.

The app.py file contains three main parts: Installing dependencies, formatting the data into JSON data, passing the formatted data back to the user/requester.

What is an API?

An API (Application Programming Interface) is like a bridge that lets different programs talk to each other. It lets one app to ask for data or services from another and get a response.

For example, when my backend app runs a search using the Hacker News Search API, it sends a request, gets data back, and processes it into JSON format to return to the user. This helps different parts of software work together easily.

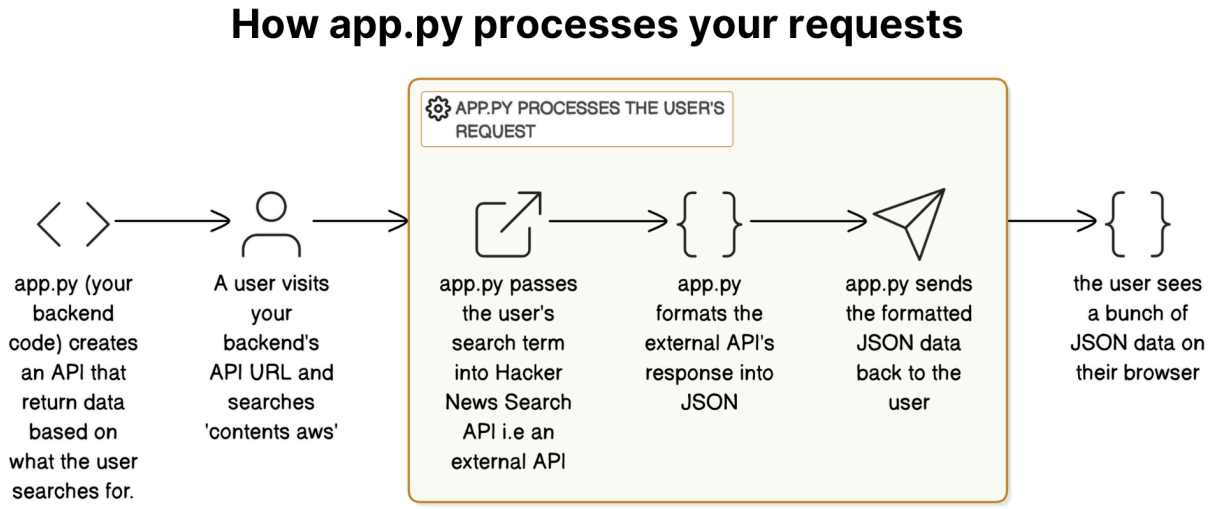
In my own backend app, **I also create MY own API** using Flask. This API takes user input, connects to the Hacker News API to get the data, processes that data, and then sends it back as JSON.

APIs make it easy for my backend to collect data from Hacker News and then share information back to my users and other services.

That's the backend code investigation all done!

Let's wrap up with a quick summary:

1. My app's backend **fetches data** based on a search topic I enter.
2. The backend code uses **Flask** to connect with an **external API** (Hacker News Search API) and process the data.
3. The backend then sends the data back as formatted JSON.



After reviewing the app's backend code, I've learnt that the app functions by extracting data from another API, but I also have my own API in app.py that's responsible for others wanting access to my service!

Thank you !!